consistency of the measured velocities of stars when due allowance is made for the varying effect of the earth's movement. Dr. Belopolsky, however, has recently suggested a method (*Astr. Nach.* No. 3267) of demonstrating the principle by a laboratory experiment. Imagine two cylinders with axes parallel, on which are arranged vertically two sets of small mirrors, a, b, c . . ., m, n, o . . . The mirrors are inclined so that a ray of light falling on a is reflected to m, back again to b, then to n, and so on, finally being directed to the slit of the spectroscope. If now the cylinders be set in rapid rotation, in opposite directions, the effects of the mirrors will be to accelerate or retard the velocity of the ray of light according to the directions of movement. Figures are given which indicate that measurable displacements may be obtained by employing cylinders of from 0·25 to 0·7 m. diameter, with ten or twenty mirrors, making from eighty to twenty revolutions per second. With cylinders half a metre in diameter, making eighty revolutions per second, and having twenty mirrors, the equivalent of a velocity of five kilometres per second in the line of sight is obtained, and with modern instruments there would be no difficulty in observing the effects of such a movement. It is pointed out that dynamos already make from seventy to eighty revolutions per second, and if sufficient care be taken in the construction of the cylinders, the experiment does not seem to present insuperable difficulties.

"THE ASTROPHYSICAL JOURNAL." This is the title under which *Astronomy and Astro-Physics* will appear in future. The University of Chicago has purchased that journal, and arrangements have been made to carry it on under the editorship of Profs. Hale and Keeler, assisted by Profs. Ames, Campbell, Crew, Frost, and Wadsworth, and a number of associate editors, five of whom represent Germany, Great Britain, France, Italy, and Sweden. The scope of the new publication will be quite as broad as that of *Astronomy and Astro-Physics*, for all problems and investigations of modern physical astronomy will be dealt with. The journal will, in fact, represent the common ground of physics and astronomy, and it should therefore be appreciated by the physicist as much as by the astronomer. Workers in astronomical physics should be gratified that their science has progressed sufficiently to need a special organ to be devoted to its interests. *Popular Astronomy* will be continued as heretofore, and will appeal to all amateurs, teachers and students of astronomy, and others interested in celestial science. This journal will be practically the old *Sidereal Messenger*, and the *Astrophysical Journal* will be the realisation of Prof. Hale's original plan of a periodical for workers in the domain of the new astronomy.

ELLIPTICAL ORBITS.—A little pamphlet on elliptical orbits, by Mr. H. Larkin, has been published by Mr. Fisher Unwin. If it should induce any student of astronomy to construct for himself the curves in which the apparent orbit of a binary star, as we see it, may be resolved, it will serve one useful purpose, and probably the only one. For it is to be hoped that the same student will not embrace the theory of formation of binary stars as given here, wherein they are made to result from the explosion of one larger star. There are many other strange things taught, of which Newton never dreamed, and which no one capable of reading Newton would ever have stated. Perhaps the most singular is the suggestion of "precarious equilibrium" that would accompany motion in a circular orbit. "Precarious equilibrium" is a curious term, but the context seems to suggest that some catastrophe or disaster would result from such a condition. The author does not seem to have realised that there is no sudden and violent change between an ellipse of small eccentricity and a circle, and that in the solar system there are instances in which the eccentricity (if existing) is so slight that the motion can be conveniently considered as circular.

FORESTRY IN NATAL.[1]

NATAL lies between latitude 28° and 31° S. The climate of the coast is almost tropical, owing to a warm current from the equator. Mangrove trees grow along the coast, and sugar-cane and tropical Indian fruit trees are cultivated there. The land ascends rapidly inland, and the capital, Pietermaritzburg—or Maritzburg, as it is usually called, at fifty miles from the coast—is at 2275 feet above sea-level, and possesses an appreciably mild climate.

The colony is bordered on the west by the Kathlamba or Drakensberg, a mountain chain attaining altitudes which exceed 9600 feet, and separating Natal from the Transvaal, the Orange Free State, and Basuto-land. These mountains form the eastern boundary of the high South African plateau, which is drained by the Orange River and its tributaries.

Natal is scantily populated, containing 18,755 square miles, with 532,000 inhabitants, of whom 38,000 only are Europeans. Most of the latter are English who came by sea and founded Port Durban, but a few are descended from the Dutch Boers who came from the west in 1838–42 and founded Maritzburg. Natal has been an English colony since 1843, when the territory only included 3000 native inhabitants, but their numbers rose rapidly to 100,000 in 1845, and to 400,000 in 1883. They are mostly Zulus in the north, and Kaffirs in the south of the colony.

Much greater progress could have been made in Natal, in trade, agriculture, and manufactures, if it had been connected by roads and railways with the Transvaal and Orange States. The Cape railway, 650 miles long, from Cape Town to Kimberley, with express trains doing the distance in thirty-six hours, has long been constructed, and in 1893 this railway was extended to the Transvaal gold mines at Johannesberg.

In 1880 a railway was constructed from Durban to Maritzburg, but only recently has it been pushed further inland, and it now reaches the confines of the colony. Its further extension to Johannesburg is most important for the future prosperity of Natal. About one and a half years ago a railway was made from Ladysmith in Natal to Harrismith in the Orange State. Natal is at present short of funds, and this may partly explain why, having made a good start in forest conservancy, the Colonial Government has not had the resolution to persevere in it.

The Cape Colony has had for some time a good forest administration which was organised by a French forest officer, Count Vasselot de Regné, Conservator of Forests in Algiers, and Mr. D. E. Hutchins is now Chief Conservator of Forests at Cape Town. He was trained at Nancy for the Indian forest service, and left it for service at the Cape in 1883. Mr. Fourcade, of the Cape forest service, was employed in Natal for nine months in 1889, and has written a very valuable paper on the Natal forests, but he declined to quit the Cape service permanently for that of Natal, and was succeeded in 1891 as chief forest officer there by Mr. Schopflin, a Baden forest officer.

The work he undertook of organising a forest department in Natal was full of difficulty, especially as the forest revenues were not expected to cover the expenditure for a number of years. Irrespectively of the continual clearance of forests for the extension of agriculture, forest fires, unregulated grazing, and wasteful timber felling have so exhausted the Natal forests that the areas still covered with brushwood and forest are widely scattered over the country, and only a small percentage of them is still State property.

From the coast to altitudes of about 975 feet, with an average annual temperature of 67°–71°, the forest consists of numerous species belonging to the tropical flora. The woods are not more than 30–60 feet high, but something might be made of them, as several species yield valuable timber. Unfortunately nearly all the coast forests are now private property.

In a central zone ranging in altitude between 980 and 3450 feet with an average annual temperature of 59°–67° F., extensive tracts are covered with so-called mimosa scrub, formed of several species of *Acacia;* these woods are very thinly stocked, and contain a tall grass undergrowth. The acacias bear plenty of seed, and young growth exists, but is continually being destroyed by the annual grass fires. If only protection could be afforded to these forests against fire, as has been done for the last thirty years in British India, they could be worked profitably with short rotations—twenty-four years, according to Mr. Fourcade; it is, however, probable that most of this area will be cleared for agriculture.

The present area of the coast and acacia forests is estimated at 196,000 acres of State forest, and 1,645,000 acres in private hands.

In the higher zone, from 3450 feet up to 9600 feet, with a temperate climate, and an average annual temperature of 52°–59°, the most valuable forests are situated, but they are

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[1] Translation of a paper by Sir Dietrich Brandis, K.C.I.E., F.R.S., in the *Forst und Jagd Zeitung.*

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scattered over a difficult mountainous region. Of these forests, the State possesses 54,000 acres, and 27,000 acres are in a territory assigned to the indigenous inhabitants of the country. The Government has decided that in the mountains the action of the Forest Department will be restricted to the State forests. They contain many species; *Podocarpus Thunbergii* and *P. elongata*, both known as yellow-wood, are the commonest, and their wood resembles that of the European spruce. At present the great cost of transport prevents the profitable working of yellow-wood. Amongst the remaining species, the two most valuable trees are stink-wood (*Ocotea bullata*), so named on account of the bad odour of freshly-sawn wood, an evergreen lauraceous species with a beautiful brown heart-wood, which is hard and tough; and sneeze-wood, *Pteroxylon utile*, an ally of the horse-chestnut. These woods are also highly esteemed in the Cape Colony, especially for cart and wagon making, and can be worked at a profit even from these remote mountain forests. Unfortunately these two species are only found here and there in the forests, and there is no large supply of them.

In the year 1891-92, the sale of wood by the Natal Forest Department yielded £725, while the expenditure was £1942, partly for establishment and partly for the survey of the forests. Owing to the small area of forests available, and the remote position of the State forests, Mr. Fourcade strongly recommended that plantations should be started near the towns and railways. Past experience with the blue gum (*Eucalyptus globulus*) is favourable for the success of this tree in Natal. At Arambi, near Ootacamund in the Nilgeri Hills in India, this tree attains a height of 107 feet in nineteen years, and yields 8696 cubic feet per acre. This enormous production of 457 cubic feet per acre annually was attained in latitude 11° N. at an altitude of 7426 feet above sea-level.

In the higher latitude of Natal, a similar climate to that of Arambi is found at 2275 feet above sea-level, and, according to Mr. Fourcade, mixtures of *Eucalyptus globulus*, *longifolia* and *rostrata* give an even higher yield near Maritzburg than at Arambi. Mr. Schöpflin doubts whether this will be the case; but, at any rate, the gum-trees will give a large yield, and if the wood were only fit for fuel a considerable pecuniary return would be obtained. Several of the gum-trees, however, yield splendid timber, and especially *E. rostrata*, the red gum of Southern Australia.

Timber imports into Natal average in value £180,000 a year, so that, as the indigenous forests are small, much subdivided, and unfavourably situated, the State is clearly called upon to plant up a sufficient area of the State lands. Mr. Fourcade states that the land necessary for these plantations can now be purchased cheaply, and Mr. Schöpflin commenced planting operations. This useful measure is now abandoned, owing to want of funds, and the plants in the State nurseries will be sold.

Besides *Eucalypti*, several Australian acacias succeed admirably in Natal, especially *A. decurrens* and *mollissima*; their bark is rich in tannin, and a plantation of 1200–1500 acres of these trees has been started by a private company. Near the neighbouring Transvaal gold-fields, Australian trees are being planted on a large scale to supply mine-props.

The length of rails in Natal is about 625 miles, and the mountain forests will yield a portion of the necessary railway sleepers. Yellow-wood must be kyanised, as has been done in the Cape Colony, and kyanising works can easily be established in Natal, and wood from gum-tree plantations ought to supply the balance of the sleepers required.

It is evident that Natal cannot possibly prosper without a Forest Department, and the colony will have cause to regret having abandoned the attempt to form one, after such an excellent beginning has been made. The Government wished to retain Mr. Schöpflin's services up to March 31, 1894, but would not undertake to employ him after that date. Under these circumstances, he was obliged to resign his appointment last September, in order to return to the Baden Forest Service.

W. R. FISHER.

THE FERTILISATION OF "LORANTHUS KRAUSSIANUS" AND "L. DREGEI."

THE parasite *Loranthus Kraussianus* grows on the coast here on the tree *Chætacme Meyeri*, and as three of these trees grow within a short distance of my house, I have this season had a good opportunity of observing the rather curious mode of its fertilisation. In the flower bud the corolla segments adhere along their whole length, forming an upright cylinder, of about an inch long, of red and white, thus getting the not inappropriate colonial name of "lighted candles." The flowers grow in close umbels, so close together as to give quite a reddish tinge to the host tree. After a little time five slits appear about half-way up the upright cylindrical corolla, and these slits are about one quarter the length of the cylinder. The anthers occupy *almost* the extreme tip of the cylinder, and are pressed against each other by the closed tube of the corolla (the cylinder aforesaid), the actual tip being occupied by the capitate stigma. If a needle be inserted into one of the slits of the corolla with a downward movement, as if to seek the nectar at the base, it causes the tube to split with some force, and at the same time the anthers are quickly and forcibly released from their pressure one against the other, and fly downwards violently, scattering practically all the pollen they contain by the one movement; and at the same time the stigma, from being upright, springs to an angle of, say, 40 degrees on one side quite clear of the now split corolla tube. I found by microscopic observations of a number of stigmas just at this stage, that only in a small proportion of cases (I only found one) did any of the triangular pollen actually reach the stigma by the act of explosion, although the style was fairly thickly peppered. These flowers are constantly being visited by large numbers of the commonest coast sunbird (*Cinnyris olivaceous*), a very active and hard-working, though not very brightly coloured, member of the sunbirds. A little quiet watching will show the birds at these flowers splitting open flower after flower, and getting head and bill covered with pollen in moving about, undoubtedly fertilising the capitate receptive stigmas (in the receptive stage protruding free from the corolla tube) of other and older flowers. After seeing them thus at work, the question arose whether without their aid the bursting of the flower happened. The negative evidence was that although I had observed for many hours, I never saw a simple flower voluntarily explode; but to check this, I put a net-bag over a small branch containing, say, 80 to 100 healthy flowers. I found that when thus protected hardly a single flower got to a further stage than having the splits on the corolla tube ready for the outside aid of the sunbird to enable them to perform the next function, viz. explosion. Actually none exploded, and, as a consequence, not a single flower within the bag set seed. They seem to be quite sterile without outside help, the anthers dehisce, but at a level below the capitate stigma, and as the corolla tube is generally upright the pollen is lost even as a self-fertilising agent. After careful watching, I feel sure sunbirds are the only effective agents in the fertilisation of this plant. At first I never observed bees visiting it, and actually made a note to the effect that they did not do so; but at a later date they came in good numbers. They seemed simply to follow the birds, and take any nectar left by them in the exploded flowers, and very seldom, and then, I think, only by a happy chance themselves caused the explosion. I did not observe any other insect visitors, so that it would appear this plant is dependent on *Cinnyris*; and there is an element of irony in it, for from the berries of this plant the boys make bird-lime, and the energetic efforts of these lovely little birds are towards the perpetuation of the means by which they are often made captive. It would be interesting to know how far the different individuals of *Loranthus* on the one tree are in the position of independent individuals of terrestrial species (pollen from an *independent individual* being necessary for the most perfect results of cross-fertilisation), or whether the fact of having a common host approximates them in this respect to the position of one plant, and whether to get the best results of cross-fertilisation pollen should be brought not from flowers of a different individual on the same host, but from plants growing on a different tree altogether. To carry on the life-history of this plant, my friend Mr. Harry Millar, of Durban, informs me that the berries when ripe are taken by the little tinker bird (*Barbetula pusilla*), who eats the *covering* of the berry, and rejects the seeds and viscid matter around them, and to clear away the latter bangs the berry with his bill against a tree, where the seeds adhere with the viscid substance and germinate. I may say that Mr. Millar states that in shooting these birds, as specimens, he often finds the head and bill covered with pollen. I am informed that another sunbird (*Cinnyris Verreauxi*) visits this plant, but as it is of the same habits as *C. olivaceous*, the results of its visits, as far as the plant is concerned, would be the same.

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